



Evolving pediatric epidural practice: An institution's clinical experience over 20 years - A retrospective observational cohort study

Gupta et al. Pediatric Anesthesia. 2020; 30:25-33

This 20-year single centre retrospective observational cohort study looked at paediatric epidural anaesthesia (PEA). The study had two primary outcomes: patterns of epidural use over time and serious adverse events (SAE). SAEs included life threatening events, death or disability or increased length of stay. The study had three secondary outcomes: global satisfaction ratings, complications (any problem not deemed an SAE) or technical problems with the equipment.

Methods

The study ran from January 1996 to September 2016. All children receiving an epidural with indwelling catheter were included. Epidurals were inserted in theatre by an anaesthetist. The standard PEA infusion used was local anaesthetic with opioid. Standardised post-operative care followed trust protocols. Naloxone, adjuvant analgesia (paracetamol +/- NSAIDs) and dual anti-emetic prophylaxis (ondansetron and cyclizine) was prescribed unless contraindicated.

Results

3,876 epidurals were sited. Median age 4.4 years; median weight 20.3 Kg. Epidural use decreased from 4.4% in 1996 to 0.45% in 2016. Urology was the specialty with most frequent use. General surgery had the biggest decline. There were 12 SAEs; 3 deaths, 2 cardiorespiratory arrests, 2 epidural collections, 1 permanent nerve injury, 1 drug error and 3 respiratory depressions requiring naloxone. Most SAEs were felt not to be related to the epidural. Overall satisfaction with PEA was 'very good or good'. Technical issues included pump failures, disconnections and the catheter falling out early. Post-operative nausea and vomiting (PONV) and pruritis was common, experienced in over one third of cases.

Discussion

PEA use has decreased over time. Reasons for this are a change in clinical practice with increased minimal access surgery and regional nerve block techniques, enhanced recovery and reduced clinician experience. The low SAE and complication rates are similar to other studies with ongoing high global satisfaction. This study demonstrates PEA to be a safe and effective method of post-operative analgesia

Reviewed by Hannah Lewis

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Thirsty work: Exploring children's experiences of preoperative fasting

Al Robeye et al. *Pediatric Anesthesia* 2020; 30: 43 – 49.

The APAGBI issued a consensus statement recommending paediatric patients can have clear fluids until 1-hour before general anaesthesia. This is one of a few studies to report responses from children about fasting. This is a single centre prospective mixed-methods study. The primary aim to collect data on children's emotional and physical experience of fasting. Secondary objectives to collect information on fasting times and contributing factors.

Methods

Study period was two weeks. Two surveys used to collect data. One for parents to about actual fasting times and the information provided. The second for children > 6 years old attending the day-case unit for elective procedures. This comprised visual Likert scales for hunger and thirst and a free text section. Two independent researchers assigned codes to children's comments to develop key themes. Data analysed using SPSS version 23.

Results:

48 questionnaires from children and 71 from parents. Mean fasting times; 11.7 hours for solids and 6.9 hours for clear fluids. Morning list patients fasted significantly longer than afternoon. Most parents received only written information about fasting. These children were found to have the more prolonged fasts. Around one-third of children felt 'hungry' or 'very hungry' and almost one-fifth 'thirsty' or 'very thirsty.' Most comments suggested children coped well with fasting. Some commented on feeling upset and in six cases fasting contributed to anxiety. Older children who understood reasons for fasting were less affected.

Discussion

A limitation of this study is the lack of inclusion of children < 6 years old. Arguably this younger cohort have less reserve to tolerate fasting and are less able to rationalise it. The authors emphasise the importance of providing clear verbal and written information for parents, for example 'your child should have a drink' rather than 'can'. Offering a drink on arrival to day-case wards is recommended.

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Prevalence of Isoelectric Electroencephalography Events in Infants and Young Children Undergoing General Anesthesia

Yuan I et al. *Anesthesia & Analgesia*. February 2020; Volume 130: 2

Methods

The Children's Hospital of Philadelphia presents a single centre, prospective observational study. The priori is to examine the prevalence of isoelectric events (amplitude $<20 \mu\text{V}$, lasting ≥ 2 seconds) using a six channel electroencephalogram (EEG) under sevoflurane or propofol anaesthesia. Sixty infants recruited ranged from 0-37 months were undergoing general anaesthesia for common elective surgical procedures. No deviation of standard anaesthetic management was mandated. EEG data was recorded from induction to extubation and was blinded to the responsible clinicians. Raw data was processed by EEG software and MatLab used to generate prevalence and duration of isoelectric events. Quality assurance was provided by an independent encephalographer and impedance constraints.

Results

Yuan et al report 63% ($n = 51$) of the infants experienced isoelectric events under anaesthesia. Nine infants enrolled were excluded due to EEG artefact. Most isoelectric events occurred in the phase between induction and knife to skin. No significant difference was observed in event prevalence between propofol or sevoflurane maintenance of anaesthesia. Secondary analysis revealed isoelectric events were associated with propofol boluses, use of an endotracheal tube and reduction in mean arterial pressure.

Limitations

Whilst distinct age bands were created with equal numbers to allow analysis of age appropriate EEG morphology other demographics were not matched with an overall 82% male preponderance in the study. The authors chose a six channel EEG monitor for clinical use but this monitor only examines the frontal cortex and not other areas of the brain. The study was not appropriately powered for the associations reported as part of the secondary analyses. Lastly and perhaps most crucial is the clinical relevance of isoelectric events remain unknown. The study does not examine any neuro-developmental outcomes and we are unable to interpret data on emergence delirium as the study was not powered for this.

Take Home Message

This is an interesting and original study which appropriately suggests delivering anaesthesia for children based on population pharmacokinetics and cardiovascular parameters has its limitations. Could EEG be a realistic or useful tool in the future to aid titration of anaesthesia for children? Reporting prevalence of isoelectric events under anaesthesia may be the early steps toward this.

Reviewed by Dr Kira Achaibar

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Eliminating international normalised ratio threshold for transfusion in paediatric patients with acute liver failure.

Lee et al. *The Journal of Clinical and Translational Research*, February 2020, 34(4):e13819

Methods:

Lee et al present a retrospective single centre study examining the impact of a transfusion threshold (INR >3) versus clinical judgement approach to transfusion in acute liver failure (ALF) patients awaiting transplant. Clinical judgement was based on presence of active bleeding, type of procedure and laboratory or viscoelastic studies. Study outcomes included: type and volume of blood product transfused 48 hours prior to transplant, intra-operative transfusion, re-laparotomy within a week, graft and patient survival at one year and post-operative renal dysfunction.

Results:

Fourty four children were recruited to the trial from 2009 to 2018. Cohorts divided by management (transfusion threshold n=30 versus clinical judgement n=14) did not significantly differ in demographics, aetiology and severity of acute liver failure. Pre-operatively, the clinical judgement cohort demonstrated a reduction in fresh frozen plasma transfusion, increase in cryoprecipitate use with no difference in platelet or red cell transfusion. Intra-operatively, blood product consumption was similar between groups with the exception of increased cryoprecipitate use in the clinical judgement arm. No significant difference was observed in re-laparotomy, one year graft survival, renal injury or death across groups.

Limitations:

The study design involved data collection from 2009-2015 where transfusion practice at the centre was based on INR threshold and from 2015 to 2018 where transfusion was determined by clinical judgement. Hence, limitations include retrospective bias, non-parallel data collection and inconsistent numbers of children recruited to each cohort. Furthermore, the ability to examine and interpret secondary outcome measures including re-laparotomy, graft survival at 1 year, post-operative renal dysfunction and death are statistically limited due to the small sample size.

Take Home Message:

The authors suggest an INR threshold is unlikely to be an accurate guide for transfusion in the context of paediatric acute liver failure. Using a composite measure of clinical judgement to assess bleeding and viscoelastic assays may allow more targeted blood product resuscitation reducing the risks associated with transfusion.

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Defining benefit threshold for extracorporeal membrane oxygenation in children with sepsis-a binational multicenter cohort study.

Schlapbach LJ, Chiletto R, Straney L, et al. *Critical Care* 2019; 23(1): 429

This was a multi-centre retrospective cohort study looking at the effect of VA-ECMO on mortality in patients <16 admitted to PICU with refractory septic shock. From 2002-2016 data was collected and analysed on 5062 children who fit the inclusion criteria of admission to ICU with sepsis or septic shock as the principal or underlying diagnosis. Cases were children who received VA-ECMO for cardiorespiratory failure in septic shock requiring either prior use of inotropes or ECPR, while controls were patients with the same diagnosis who did not receive ECMO. The primary end point was ICU mortality.

The authors used a multivariable model to predict mortality including severe respiratory failure, shock or cardiac arrest, high lactate and immunosuppression as significant predictors. This was well calibrated with an AUROC of 0.8798, and was used to calculate predicted mortality, with a benefit threshold of 47.1%, above which ECMO was thought to have a survival benefit.

80/5062 received ECMO (1.6%). These children were more likely to have undergone inter-hospital transfer and were sicker on admission. 36/80 patients (45%) died. Mortality for children treated with ECMO below the threshold was 41.8% compared to predicted mortality of 30.0%, and mortality for children above the threshold was 52.0% compared to predicted 68.2%. Amongst the ECMO fatalities, independent mortality predictors were high lactate, cardiac arrest pre-ECMO and central cannulation.

Take home message

- Current guidelines for management of septic shock in children recommends ECMO as an adjunctive rescue therapy, based on selective case reports. This was the first study to assess a benefit threshold for ECMO.
- Children with a high prediction of mortality (>47%) may benefit from ECMO, below this level harm outweighs the benefit.
- This was not an RCT and cannot be recommended as accepted practice although it does suggest ECMO may be useful in the higher risk and sicker patients.

Reviewed by Dr Stephen Meneely

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Fibrinogen Concentrate as an Alternative to Cryoprecipitate in a Postcardiopulmonary Transfusion Algorithm in Infants Undergoing Cardiac Surgery: A Prospective Randomized Controlled Trial.

Downey LA, Andrews J, Hedlin H, et al. *Anaesthesia and Analgesia* 2020;130(3):740-751

Infants undergoing cardiac surgery with CPB are at risk of bleeding due to immature coagulation systems with impaired fibrinogen function, combined with the haemodilutional effect of CPB and complex surgery. Low fibrinogen levels are associated with need for allogenic blood transfusion, both being predictors of worse outcome. Cryoprecipitate is used to increase fibrinogen but is an allogenic blood product requiring cross matching and thawing, associated with volume overload, potential pathogen transmission and immunological reaction. Fibrinogen concentrate (FC) is purified fibrinogen undergoing pasteurization to minimise risks. It comes in smaller volumes and is immediately available.

This was the first study of FC as an alternative to cryoprecipitate in infants undergoing cardiac surgery with CPB. It was a 2-centre, prospective, RCT with 60 infants randomised to receive FC or cryo as part of post-CPB transfusion policy. The primary outcome was difference in number of intra-operative blood transfusions. It was partially blinded with the anaesthetist being aware of allocation, surgeons and ICU staff not. Anaesthesia and CPB followed institutional guidelines with ABG's, TEG's and fibrinogen measured pre-incision (T1), 10 minutes after CPB initiation (T2), and post CPB termination, protamine reversal, and transfusion of cryo/FC (T3). There were no differences in baseline demographics or intraoperative characteristics and analysis of the primary outcome followed intention to treat format.

The FC group received significantly fewer transfusions-4, (IQR 3-5), than the cryo group-5.5 (IQR 4-7). Adjusted figures showed the FC group received a mean of 1.79 (95% C.I., 0.64-2.93; P=0.003) less transfusions. In patients at high risk of bleeding, the cryo group received a median of 9.5 units (IQR 6.5-10.8), compared to 5 units in the FC group (IQR 4-6)

Take home message

- Low fibrinogen levels associated with bleeding and worse outcomes in cardiac surgery, magnified by the effect of CPB on immature coagulation systems in infants.
- FC may be an alternative to cryoprecipitate and is associated with fewer adverse reactions, effects most pronounced in patients at high risk of bleeding.
- Patients required fewer transfusions with no significant disadvantages
- Cryo should be considered with physician discretion and experience crucial in maintaining haemostasis.

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